

February 25, 2011

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
92-460 Farrington Highway  
Kapolei, Hawai'i 96707

Attention: Mr. Joe Whelan

Subject: Liner Damage Assessment, Repair, and Construction Quality Assurance Report  
for Cell E6 Sideslope, Waimanalo Gulch Sanitary Landfill, Kapolei, HI

Dear Mr. Whelan:

## **1.0 INTRODUCTION**

This letter report presents a liner damage assessment and construction quality assurance (CQA) documentation of liner repairs recently completed for the municipal solid waste (MSW) Cell E6 at the Waimanalo Gulch Sanitary Landfill (WGSL) at 92-460 Farrington Highway in Kapolei, Hawai'i. A series of storm events occurring in late December 2010 through mid-January 2011 resulted in high surface runoff flows that flooded MSW Cell E6 and damaged portions of the liner system.

## **2.0 DAMAGE ASSESSMENT**

In late December 2010, a series of storms produced high run-on at the site resulting in damage to the northeastern edge of the MSW Cell E6 liner where it joins with Cell E4. Another large storm arrived on the evening of January 12, 2011 that resulted in additional flooding of the landfill and damaged the exposed portion of the western sideslope area of the MSW Cell E6 liner system. The damaged areas are shown on Figure 1, Attachment 1.

This letter report focuses on repairs to the accessible portion of the Cell E6 liner sideslope, located in the middle section of the sideslope, along the western side of Cell E6. This Liner Damage Assessment, Repair, and Construction Quality Assurance Report follows the *Workplan for Liner Evaluation and Repair* prepared by Geosyntec Consultants, Inc. dated January 27, 2011. The damaged liner area along the northern sideslope area will be investigated at a later date when rockfall hazards above the liner sideslope have been removed. The southern sideslope liner area above the sump area will also be investigated at a later date when the sediment that is currently covering the area has been removed in preparation for final cover installation in this area.

The high water flows during the storm event resulted in erosion of the termination bench and exposed operations layer soils covering the sideslope liner, thereby exposing the liner to subsequent damage by falling rocks in addition to allowing sections of the liner to pull down from the termination bench creating wrinkles. Due to numerous holes in the exposed sideslope liner at the northern end of the cell caused by falling rocks, water and sediment were able to flow between the geotextile, 60-mil geomembrane, and geosynthetic clay liner

(GCL) layers. Portions of the GCL in the middle area of the sideslope area were hydrated and covered with sediment due to the water and sediment flow.

Work began on February 3, 2011 to repair the wrinkles and expose the sections of the sideslope liner that contained hydrated GCL. Repairs were completed on February 17, 2011. An excavator and hand labor were used to carefully remove any MSW, operations layer, and sediment off of the liner system so it could be inspected. Inspection holes were cut through the multiple layers of the liner system to determine if the GCL had been hydrated and where sediment had been deposited. This uncovering process continued until all damaged areas were exposed in the middle area of the sideslope. No damage to the subgrade cushion soil was observed during the inspection. The area requiring repair is shown on Figure 2, Attachment 1.

Once the damaged liner area was fully delineated, repairs were conducted to remove any wrinkles, hydrated GCL, and trapped sediment between the liner system layers. Following removal of damaged liner material, the liner system components were replaced with new material. Details of the repair activities and CQA observations are presented in Section 3.0. Areas to the north and south of the repair area will be uncovered later in 2011 when rockfall hazards/sediment are removed and these conclusions can be verified.

### 3.0 CONSTRUCTION QUALITY ASSURANCE ACTIVITIES

The participants in the Cell E6 repairs at WGSF and their respective roles are noted below:

- General Contractor: Goodfellow Brothers Inc.
- Geosynthetic Materials Repair Contractor: American Environmental Group, Ltd. (AEG)
- CQA Observation: AECOM Technical Services, Inc. (AECOM)

AECOM's CQA officer/project manager performed oversight for the documentation procedure including both fieldwork and report preparation. The CQA officer also prepared the documentation report and provided the engineering certification. The CQA officer's statement is included in Attachment 3. All repair work was performed in accordance with the following documents prepared by Geosyntec Consultants, Inc:

- *Technical Specifications and Construction Drawings, Cells E5 through E8, Waimanalo Gulch Landfill, Ewa Beach, O'ahu, Hawai'i*, dated January 2010 with revisions dated February 11, March 11, and March 16, 2010.
- *Waimanalo Gulch Landfill, Workplan for Liner Evaluation and Repair*, dated January 27, 2011.

Details of the CQA performed on the original MSW E6 construction can be found in:

- *Construction Quality Assurance Report for Cell E6 (Partial), Waimanalo Gulch Sanitary Landfill, Kapolei, Oahu, Hawaii* (AECOM, October 2010)



### **3.1 SUBGRADE PREPARATION**

No damage to the subgrade was observed during the Cell E6 western sideslope repairs; therefore, no subgrade preparation was necessary.

### **3.2 GEOSYNTHETIC MATERIALS**

Geosynthetic materials used to repair the liners were obtained from the stockpile of remaining material used for the Cell E6 (Partial) construction. Manufacturer's quality control documentation, conformance testing, and interface friction results for the materials were presented in the original E6 CQA report referenced above.

### **3.3 TRIAL WELDS**

Trial weld samples were produced several times during each day's production seaming. The seams were made by AEG technicians on representative pieces of the geomembrane to monitor each seaming apparatus and operator under the daily site conditions. At a minimum, trial welds were performed once in the morning and again during early afternoon. The trial seams were observed, monitored, and documented by AECOM.

Trial weld samples were a minimum of 5-ft-long by 1-ft-wide after seaming, with the seam centered lengthwise. Two specimens, measuring 1-inch-wide, were die-cut from each trial seam. The specimens were tested by AEG, for peel adhesion and bonded seam strength (shear strength) using an onsite tensiometer supplied by AEG. The tensiometer certification is presented in Attachment 5.

For the 40-mil geomembrane, the specified strength for peel adhesion was 52 pounds per inch (ppi) for extrusion welds. The specified strength for shear specimens was 80 ppi. In addition to the strength criterion, specimens were required to fail outside of the weld area in a film tear bond.

For the 60-mil geomembrane, the specified strength for peel adhesion was 78 ppi for extrusion welds. The specified strength criterion for shear specimens was 120 ppi. In addition to the strength criterion, specimens were required to fail outside of the weld area in a film tear bond.

Production seaming was conducted after passing results on trial welds were achieved. Each trial seam was assigned a number, and pertinent information was recorded by AECOM. The summary of the trial weld seam results is presented in Attachment 6.

### **3.4 GEOMEMBRANE REPAIRS**

The repair area and repair locations are shown on Figure 2 and Figure 3 in Attachment 1. The area is along the sideslope area of Cell E6, corresponding to originally installed panels P2-1 through P-16 (60-mil panel numbers), and is approximately 250-ft long in the north-south direction and 70-ft wide in the east-west direction. Repairs to the geomembrane were made at locations where the liner was physically damaged during the storm events, in addition to areas cut to remove wrinkles, sediment, or hydrated GCL.

During geomembrane installation, welding was performed using either the fusion or extrusion method. Upon completion of welding, each seam was tested for integrity and

continuity using non-destructive and destructive test methods described in Sections 3.5 and 3.6, respectively.

The extrusion welding procedure was used primarily for long cuts made in the geomembrane to remove wrinkles and the encapsulating weld. Also, extrusion seams were made at repair locations and other locations where fusion welding could not be performed. Fusion welding was used to join large repair panels. A more detailed description of each of the welding methods is presented in the following paragraphs.

**Fusion Welding.** To produce a fusion-welded seam, an AEG technician first prepared the surfaces to be welded by wiping the geomembrane panel edges clean and trimming excess overlap. The edges of the two panels were then placed into the welding machine. Two “hot-wedges” heated the geomembrane surfaces of both panels to molten material. The melted surfaces of the top and bottom layers of the overlap were then compressed by the drive rollers of the welding machine. In this way the welding machine produced two parallel fusion welds, or “tracks,” with a small air channel between them. The air channel was used for non-destructive continuity testing of the fusion weld, as discussed in Section 3.5.

AEG seaming technicians continually monitored the seaming operations and adjusted settings on the welding machine as necessary.

**Extrusion Welding.** To produce an extrusion weld, two pieces of geomembrane were temporarily tack welded together with a heat gun. Once tacked together, the edges of the two-geomembrane surfaces were then ground to provide a clean rough surface on which to place the extrusion weld. A technician then used a semi-automatic hand-held extrusion welding machine to produce the extrusion seam.

AEG seaming technicians continually monitored the seaming operations and adjusted settings on the extrusion welder as necessary.

The repairs were documented by recording the date repaired, location, description of damage, size and type of repair, crew that made the repair, date, and technician that conducted the non-destructive test on the repair.

Dates, locations, dimensions, and testing of seaming and repairs to the geomembranes are presented in the Panel Seaming Summary and Geomembrane Repair Summary in Attachment 6. Photos of the repair activities are included in Attachment 2.

### 3.5 SEAM NON-DESTRUCTIVE TESTING

All geomembrane seams were non-destructively tested. Fusion welded seams were air pressure tested, and extrusion welds were vacuum box tested. AEG performed all non-destructive testing. AECOM CQA personnel observed non-destructive testing procedures and documented test location, test information, identity of AEG seaming technician, and the test results. Non-destructive seam testing information is provided in Attachment 6.

To begin air pressure testing of a fusion weld, the air channel between the two “tracks” of the fusion was heat sealed on both ends of the seam to provide a completely closed air chamber along the length of the seam. Next, a hollow needle, fitted into a pressure gauge, was inserted into the air chamber. The air in the channel was pumped to a pressure



between 30 and 35 pounds per square inch (psi) and the pressure in the channel was allowed to stabilize for 2 minutes. After stabilizing, the beginning pressure was recorded and the seam was tested for at least 5 minutes. If the pressure dropped more than 2 psi during the 5-minute test, the seam was considered to have failed the test.

At the end of the 5-minute test period, the AEG technician walked to the end of the seam opposite from the pressure gauge and pierced the air channel. AECOM CQA personnel observed the needle on the pressure gauge drop. A drop in pressure indicated that the air channel had not been blocked and the entire seam had been tested. If the air pressure did not drop, the blockage in the air channel was located and marked for repair, and air testing was conducted on both sides of the blockage.

If a seam failed air pressure testing, the area where the needle was inserted into the air channel was checked for leaks. Next the heat-sealed ends of the seam were checked for leaks. If no air was found to be leaking at these locations, the AEG technician performed a visual inspection of the seam. If the leak was located visually, the seam was cut on either side of the leak, the air channel was heat sealed between the "tracks," and the seam was retested in both directions. If the retest failed, or the leak was not found visually, the seam was either capped by extrusion welding a 1- to 2-ft-wide piece of geomembrane over the failed seam or reconstructing the seam. All repaired seams were non-destructively tested using the vacuum box method.

Upon completion of air pressure testing, repairs were made to the areas where needles had been inserted, air channels had been pierced, and blockages or leaks had been identified.

Extrusion welds were non-destructively tested using a vacuum box. The vacuum box is an 8-inch by 24-inch cast aluminum frame fitted with a clear plastic viewing window and a neoprene rubber seal. A pressure gauge is mounted inside the box.

The test procedure involved applying a soapy solution to the weld. The vacuum box was then placed over the weld and a negative pressure of 5 psi was developed in the box. This test pressure was held on the weld for a minimum of 10 seconds. If there was a leak in the weld, the vacuum would draw air from under the liner and through the leak, and bubbles would develop in the soapy solution and be visible through the viewing window. If no air bubbles appeared, the weld section being tested was considered to have passed.

Vacuum box testing was performed with a minimum overlap of 3 inches between tests as the vacuum box was moved along the seam length. Results for the vacuum box testing of each extrusion repair and extrusion seam are summarized in the Geomembrane Repair Summary and the Nondestructive Seam Testing Summary forms in Attachment 6.

### **3.6 SEAM STRENGTH DESTRUCTIVE TESTING**

A single destructive test sample was obtained from the 60-mil geomembrane seaming installed during the repairs to perform laboratory testing of the seam integrity. The destructive sample was first tested in the field by AEG's QC representative with a portable tensiometer. The calibration certificate for the tensiometer is included in Attachment 5. Test strips were cut from the destructive sample and tested for peel adhesion and shear strength. Once the field strips passed, a portion of the remaining destructive test sample was sent to the geosynthetics laboratory for testing. The laboratory sample was subsequently cut into



10, 1-inch-wide test specimens using a hydraulic press equipped with a 1-inch by 10-inch die. Five specimens were tested for shear strength and five for peel adhesion also. In accordance with specifications, peel testing was conducted on both tracks of the weld. The testing was conducted at a constant rate of elongation of 2 inches per minute. The yield load and the mode of failure for each specimen were recorded.

The acceptance criterion for 60-mil shear specimens was that 4 out of 5 specimens have yield strengths of 120 ppi or greater and that failure should not occur in the weld. The acceptance criterion for peel specimens was that 4 out of 5 specimens have yield strengths equal to or exceeding 78 and 91 ppi for extrusion and fusion seams, respectively, and that failure should not occur in the weld.

The laboratory data sheet for the destructive test sample is presented in Attachment 6. The destructive sample met the requirements outlined in the project Technical Specifications (Geosyntec 2010) and the *Workplan for Liner Evaluation and Repair* (Geosyntec 2011).

### **3.7 GCL REPAIRS**

Hydrated or otherwise damaged GCL was replaced in the designated repair area as necessary. The GCL was deployed in a manner not to entrap stones or other loose soil under the material. All adjacent panels of new GCL were overlapped a minimum of 18 inches and bentonite was applied at a rate of 1/4 pound per ft of seam. As it was necessary to remove hydrated GCL on the sideslopes, horizontal seams on the sideslope were required to complete the repairs. As outlined in Request for Information (RFI) No. 26, horizontal seams on the on slopes steeper than 10 horizontal to 1 vertical were approved by the design engineer such that the procedure include an overlap of 5 feet and gluing with 3M Super 77 glue. A copy of the RFI is included in Attachment 7. Horizontal seams installed during the repairs were completed in accordance with RFI No. 26.

### **3.8 CUSHION GEOTEXTILE REPAIRS**

Following completion of the geomembrane and GCL repairs, the 16-ounce (oz)/square yard (yd<sup>2</sup>) cushion layer geotextile was repaired using patches of new material, which were sewn using a double-stitched "prayer" style seam.

### **3.9 OPERATIONS LAYER**

Following deployment of the geotextile, the operations layer was placed over the repair area. The operations layer consisted of onsite crushed/screened sand material and placed in a 2-ft-thick (minimum) layer over the cushion geotextile.

## **4.0 CONCLUSIONS**

AECOM performed field observations and documentation of Cell E6 Repairs at WGSL as shown on Figure 1 through Figure 3. In summary, based upon our observations and test results, AECOM concludes that the work represented by the attached documentation is in substantial conformance with the original construction contract documents and their design intent, and industry standard construction practices.

Due to obvious liner damage to the northern sideslope area of Cell E6 (Partial), future MSW placement operations should be kept at least 50 ft away from this sideslope area (measured

horizontally from the sideslope at current MSW grades) to allow liner repair work to be completed.

If you have any questions or need more information about this project please call me at (808) 356-5321.

Sincerely yours,



Ronald E. Boyle, P.E.  
Project Manager  
AECOM Technical Services, Inc.

Attachments:

- 1 Figures
- 2 Photo Log
- 3 CQA Officer's Statement
- 4 Daily Reports
- 5 Tensiometer Certificate
- 6 Geomembrane Installation Documentation
- 7 Field Revisions

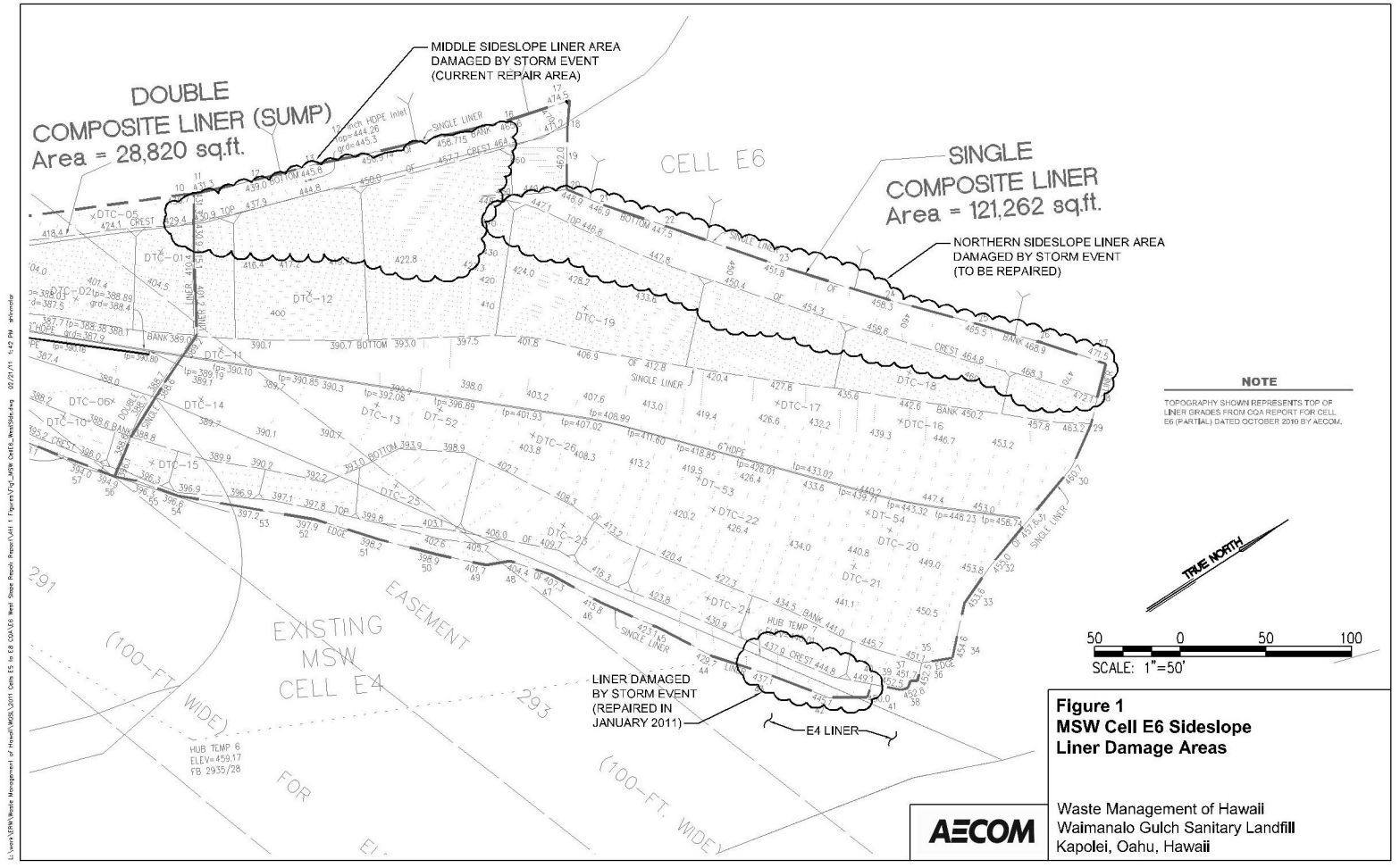
cc: Jesse Frey, Waste Management of Hawaii





**Attachment 1**  
**Figures**





**Figure 1**  
**MSW Cell E6 Sideslope**  
**Liner Damage Areas**

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
Kapolei, Oahu, Hawaii

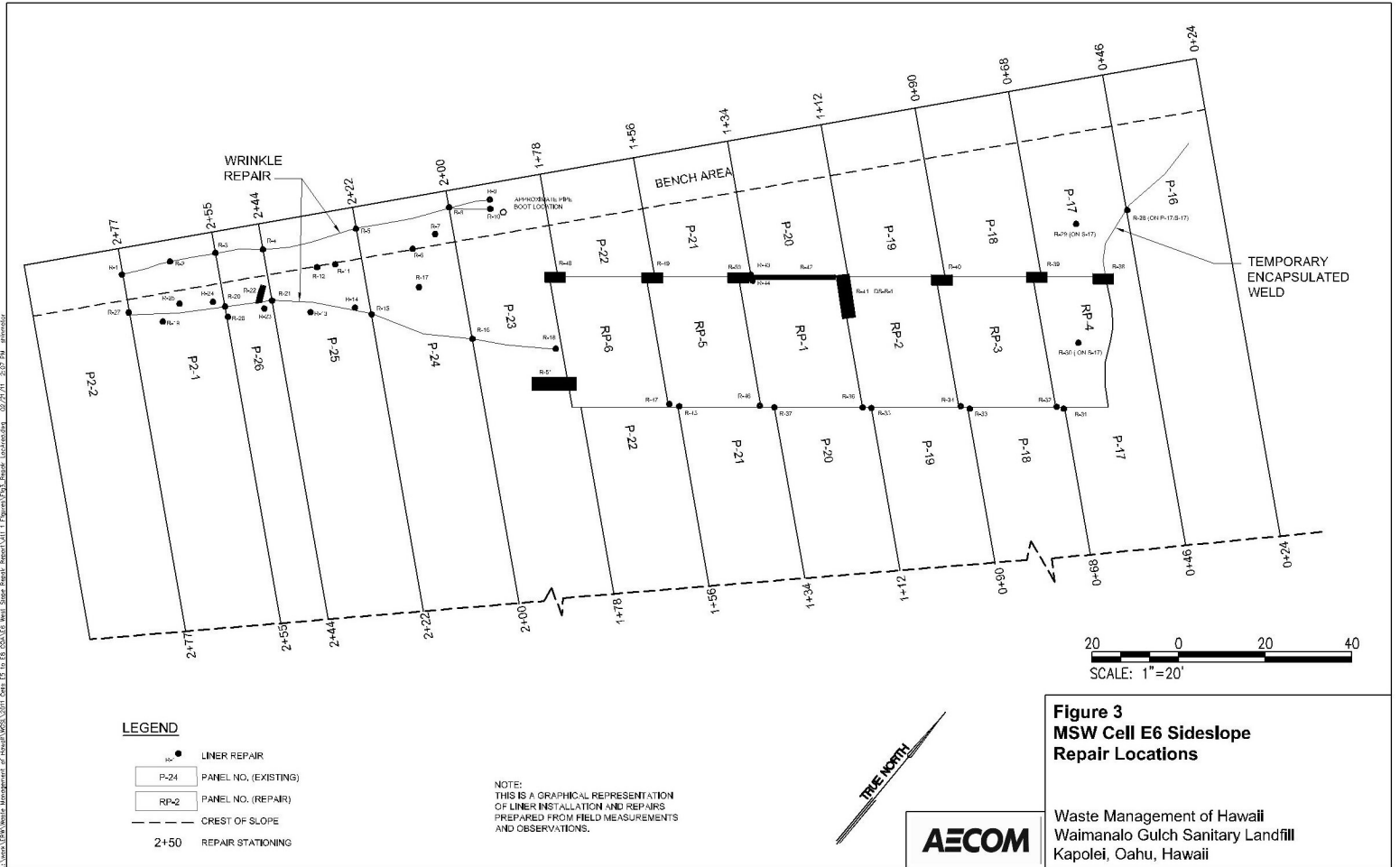














**Attachment 2**  
**Photo Log**





Photo 1: Excavator removing sediment along sideslope to expose wrinkles in liner north of the sump.



Photo 2: Removing 16-oz/yd<sup>2</sup> geotextile/sediment to expose wrinkles in 60-mil geomembrane.





Photo 3: Excavator removing sediment at toe of MSW slope to expose wrinkles in 60-mil geomembrane.



Photo 4: Preparing seam for extrusion weld with a grinder following removal of the wrinkle in 60-mil geomembrane.





Photo 5: Heat tacking a repair patch on the 60-mil geomembrane.



Photo 6: Extrusion welding of 60-mil geomembrane following repairs to remove wrinkles.





Photo 7: Non-destructive testing of a repair with vacuum box.



Photo 8: Deploying 16-oz/yd<sup>2</sup> geotextile following repairs to remove wrinkles.





Photo 9: Sewing 16-oz/yd<sup>2</sup> geotextile following deployment.



Photo 10: Exposing area with sediment under 16-oz/yd<sup>2</sup> geotextile and 60-mil geomembrane, looking north along the sideslope towards.





Photo 11: Removing sediment from between the 60-mil geomembrane and GCL along the sideslope.



Photo 12: New GCL material following removal of hydrated GCL and sediment, looking north.





Photo 13: Preparing tie-in to existing 60-mil geomembrane following removal of sediment/hydrated GCL and deployment of new geomembrane.



Photo 14: Fusion welding repair panels of 60-mil geomembrane following removal of sediment and hydrated GCL.





Photo 15: Overview of the southern portion of the repair area following removal of wrinkles and damaged liner system components, looking north.



Photo 16: Overview of the northern portion of the repair area following removal of sediment and hydrated GCL.

**Attachment 3**  
**CQA Officer's Statement**



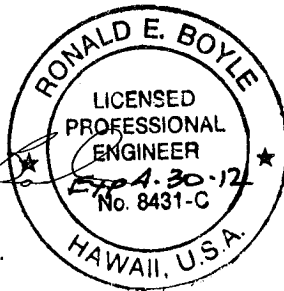
## CQA OFFICER'S STATEMENT

The quality assurance consultant for MSW Cell E6 Sideslope Repairs construction was AECOM Technical Services, Inc. (AECOM) located at 1001 Bishop Street, Suite 1600, Honolulu, Hawaii 96813.

All quality assurance activities performed by AECOM personnel were under the direct supervision of the Construction Quality Assurance (CQA) Officer or his designated representative, the CQA Monitor. The activities undertaken by AECOM are documented in the attached Construction Quality Assurance Letter Report for Cell E6 Sideslope Repairs, prepared by AECOM, dated February 2011. The monitoring, observation, and testing performed by and under the direction of AECOM have verified that Cell E6 Sideslope Repairs for the area indicated in this report were constructed in substantial conformance with the permit, approved project plans and specifications, construction quality assurance plan, and generally accepted construction practices.

The CQA Officer for this project was Mr. Ron Boyle. Additionally, Mr. Dan Braatz and Dan Frerich were on-site serving as CQA Monitors. The CQA Officer assumes full responsibility for all CQA related activities performed by AECOM at this site whether under his direct supervision or at the direction of the CQA Monitor.

AECOM



Ron Boyle, P.E.  
CQA Officer  
Registered Professional Engineer  
State of Hawaii No. 8431





**Attachment 4**  
**Daily Reports**



# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 1

Client: Waste Management of Hawaii

Date: 02/08/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

lt

High

80

Wind Direction:

Weather Conditions: partly sunny

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	1

Equipment	No. on-site	No. in-use
Gradall	1	1
Back hoe	1	1

## Daily Notations:

Arrived on site at 7.00 am. AEG waiting for Good fellow Bros to clean up liner area at the north west slope area crest that has storm damage from three different storms.

AEG crew arrived about 9.00 am and started to pull back the protective geotextile over liner area with panels numbers P-23 thru P-26 which is one encapsulated sandwich that is constructed of a 40 mil HDPE, GCL and top encapsulated with the top layer of 60 mil HDPE covered with a 16 oz Geotextile protective layer. After the top 60 mil HDPE was exposed the crew cleaned off the dirt on top of the HDPE liner.

There is about a 6" wrinkle that has traveled across the slope from P-23 which has a storm water pipe in the middle of the bench in the middle of the panel down across panels P-24 to P-26. This wrinkle appears to be only in the 60 mil layer. The liner will attempt to pull the wrinkle out up the slope and repair any damage area tomorrow.

We did expose panels P2-1 and 1/2 of P2-2. This is part of the sump layer that has the two sandwiches of encapsulated liner which consists of 40 mil HDPE, GCL encapsulated with the 60 mil HDPE layer and then 40 mil HDPE, GCL and encapsulated with the 60 mil HDPE layer with a 16 oz protective Geotextile layer. Near the toe of the the existing waste a wrinkle is going across the slope near the toe and also appears to be only in the upper 60mil layer . We will also try to pull the wrinkle out and make any needed repairs. We did notice two different spots that had about 2" holes that may have been from excavator removing soil off the geotextile. These repairs will preformed tomorrow.

I most of the crew left the site about 5.00 pm.

Name: Dan Braatz

Signature:

WMH007175

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 2

Client: Waste Management of Hawaii

Date: 02/09/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

10-15

High

80

Wind Direction:

E

Weather Conditions: partly sunny

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5

Equipment	No. on-site	No. in-use
Gradall	1	1

## Daily Notations:

Arrived on site at 7.00 am.

AEG crew arrived about 7.00 am and started to cut and pull the wrinkles out of the 60 mil top layer liner. It looks like just the top 60 mil liner had pulled down the slope. The encapsulated weld on the top edge is still intact. The crew started to cut the top liner on the flat bench area and also made a cut parallel to the slope or about mid slope. Once the liner was cut the GCL looked pretty good. It did show some moisture and dirt in some areas but I did not see any areas that showed it being hydrated that needed repairs.

Late morning the crew started to do the seaming and repairs of the areas of storm damage. The panels that were repaired today were P-23 to P2-1. P2-1 was the only panel that had the double sandwich of geomembrane layers. Trial welds were performed before any production extrusion welding was constructed. Repairs patches were placed over seam intersections and over holes that were purposely cut into the liner to pull wrinkles out. There were a few holes that were found that were either storm damage or from construction equipment pulling off soil off the liner. Repairs 1 to 27 were constructed today. See field data sheets for more detail on today activities.

I most of the crew left the site about 5.15 pm.

Name: Dan Braatz

Signature:

WMH007176

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 3

Client: Waste Management of Hawaii

Date: 02/10/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

10-15

High

80

Wind Direction:

E

Weather Conditions: partly cloudy

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	1

Equipment	No. on-site	No. in-use
Gradall	1	1
DEERE 6500 Excavator	1	1

## Daily Notations:

Arrived on site at 7.00 am.

AEG crew arrived about 7.00 am and started to do nondestructive testing of the repairs and extrusion welds that were constructed yesterday. The non destructive testing performed was vacuum box testing. All testing performed passed.

Next the crew deployed the 16oz protective geotextile over the top of the liner in our repair area. The seams were swen with a double prayer method.

Next Goodfellow Brothers operator with excavator removed the mud wave that had acumlated at the toe of the slope on panels P-17 to P23. Mud wave was cut out of geotextile and excavator open pulled soil off liner. No wrinkles were observed on these panels. Pannel P-17 on going north did have visible holes that looked like rocks from above had punched hole into the geomembrane. Temporary patchs (4) were placed on panel 17 to keep water out of sandwich until the repairs at a later day will be made.

I most of the crew left the site about 3.00 pm.

Name: Dan Braatz

Signature:

WMH007177



# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 4

Client: Waste Management of Hawaii

Date: 02/11/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

10-15

High

80

Wind Direction:

E

Weather Conditions: partly cloudy

Contractor(s) on-site	No. of people
American Env. Group (AEG)	1

Equipment	No. on-site	No. in-use
Gradall	1	0

## Daily Notations:

Arrived on site at 8.00 am.

We had a site meeting at 9.00 am. Ron Boyle and Dan Frerich on site . We first talked with GBI about repair work area south of the repair we had just completed. GBI had said that they would not be working the area south of the completed repair due construction schedule at this time and that they had priorities in other areas.

Next with met with Jesse Frey of WMI. He had instructed to us that due to filling needs that he would like to see repairs completed on panel P-16 on the north and working back to the south to the completed repair area which would be P-22. At this time there is a mud wrinkle at the toe of that area that will have to be removed to start any repairs. GBI said that they would start this Saturday morning. The panels north of P-16 has major storm and rock damage that will take some time to remove the soil and rock that is on top of the liners in that area. This could one to two months down the road.

I left the site about 1.00 pm.

Name: Dan Braatz

Signature:

WMH007178

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 5

Client: Waste Management of Hawaii

Date: 02/12/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

10-15

High

80

Wind Direction:

E

Weather Conditions: partly cloudy

Contractor(s) on-site	No. of people
American Env. Group (AEG)	1
Goodfellow Bros., Inc. (GBI)	3

Equipment	No. on-site	No. in-use
Gradall	1	0
DEERE 6500 Excavator	1	1

## Daily Notations:

Arrived on site at 7.00 am.

First this morning I met with Mat H. of GBI on the repair area. I had mentioned that the weather forecast shows a very good chance of rain the next few days and that maybe we should wait on digging holes that may fill up with water. He agreed and would try to drain the water from the rain that fell the night before that had pond at the toe.

I left the site about 8.30 pm.

Name: Dan Frerich

Signature:

WMH007179

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 6

Client: Waste Management of Hawaii

Date: 02/14/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

5-10

High

82

Wind Direction:

w

Weather Conditions: partly cloudy humid

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	3+

Equipment	No. on-site	No. in-use
Gradall	1	1
DEERE 6500 Excavator	1	1

## Daily Notations:

Arrived on site at 7.00 am.

The site was fairly saturated from the over night rain fall that may been close to an inch of rain.

GBI had an excavator removing soil and mud from panels P-16 to P-21. GBI was removing more soil beneath the mud wrinkle between the 60 mil liner and the 16 oz geotextile. They removed about another 5 feet deeper of soil/mud on top of the geotextile.

After this task AEG then cut the 60 mil HDPE liner about 5 feet up from the new toe. Once the cut was made we found fine silts on top of the GCL. Ron Boyle and Dan Frerich from AECOM were also on site. After more evaluation we found that the GCL was hydrated near the new toe but was good beneath the area that had soil weight that pinched of water and silts from penetrating even lower. It was recommended that approximate 20 feet high(up the slope) hydrated GCL be removed and replaced with new GCL panels per spefications. Crews continued to clean silts off the GCL and geomembranes.

AEG then prepped the open geomembrane to drain any possible rain fall overnight and will start the repairs first thing tomorrow morning. GBI and WM-H worked on the water seeping in the toe of the work area by digging sump hole and placing trash pumps in to pump the continuos water seeping through the sub layers.

AEG and I left the site at 4.00 pm.

Name: Dan Braatz

Signature:

WMH007180

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 7

Client: Waste Management of Hawaii

Date: 02/15/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

5-15

High

83

Wind Direction:

east/west

Weather Conditions: partly cloudy humid

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	3+

Equipment	No. on-site	No. in-use
Gradall	1	1
JOHN DEERE 350D Excavator	1	1

## Daily Notations:

Arrived on site at 7.00 am.

Today AEG cut the 60 mil HDPE liner to cut out hydrated GCL under panels P-20 to P-17 on the west slope from an approximate upper elevation of 440 based on the bench elevation of 450 to the north. Then the next lower 30 feet going down slope was removed. Once the GCL was removed, some fine silts or mud was found and removed. The lower 40 mil HDPE liner was inspected and only one puncture from a assumed rock was found and repaired (R-30). AEG placed new GCL panels in the repair area. GCL was placed by hand up the slope with a 5' overlap on cross seams. A 3m super 77 adhesive was applied to the GCL to glue the cross seams together on the slope. AEG also heat tacked the seams for added strength.

After lunch AEG began to deploy repairs panels of 60 mil HDPE liner in place. Panels RP-1 to RP-4 were constructed to replace the area removed for the GCL replacement on P-17 to P-20.

Before production seaming was preformed trial welds( TWX-15 to TWX-8)were manufactured and tested and met specifications. Both fusion and extrusion welding was performed today. One destructive sample was sampled from the fusion welding seaming today (DS-R1). See field data sheets for more detailed information.

AEG and I left the site at 6.30 pm.

Name: Dan Braatz

Signature:

WMH007181

# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 8

Client: Waste Management of Hawaii

Date: 02/16/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

5-20

High

80

Wind Direction:

east/west

Weather Conditions: partly cloudy

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	3+

Equipment	No. on-site	No. in-use
Gradall	1	1
Hitachi EX 350	1	1

## Daily Notations:

Arrived on site at 6.30 am.

Today AEG first did extrusion trial weld TWX-9 for remaining repairs on panel RP-1 to RP-4. Once repairs and vacuum testing passed the crew began to deploy protective 16 oz geotextile over the repair panels. Geotextile was sewn with double prayer seam method.

GBI continued to excavate toe area going south for repairs on panel P-22 and P21. Due to excess water filtering in through toe area GBI dug sump south of repair area and also placed drainage soil at the toe for working conditions. The John Deere excavator with the grab bucket is down for repairs today so no GCL placement will be performed today. AEG then did site and geosynthetic material maintenance.

AEG left the site at 4.00 pm and I at 3.00 to fix flat tire.

Name: Dan Braatz

Signature:

WMH007182



# Daily Field Report

**AECOM**

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 9

Client: Waste Management of Hawaii

Date: 02/17/2011

Project: Cell E-6 Western Slope Liner Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F):

Low

69

Wind Speed (mph):

5-10

High

80

Wind Direction:

west

Weather Conditions: partly cloudy

Contractor(s) on-site	No. of people
American Env. Group (AEG)	5
Goodfellow Bros., Inc. (GBI)	3+

Equipment	No. on-site	No. in-use
Gradall	1	1
Hitachi EX 350	1	1

## Daily Notations:

Arrived on site at 7.00 am.

Today AEG first cut the 60 mil liner on panel P-21 and P-22 and removed the HDPE liner and hydrated GCL from toe the the excavation up the slope about 20 plus feet. After they removed this they replaced it with new GCL with 5' overlap on the cross seams that had a 3M SUPER adhesive applied to it. Next they covered the GCL with 60 mil HDPE liner. Fusion and extrusion welding for seaming of the HDPE was performed. Trial welds TW-10 and TWX -11 were performed before any production seaming was done. The trial welds passed field testing.

After seaming was completed the crew did final detailing of air testing and vacuum testing of all new seams and repairs. See filed data sheet for more detailed information.

After detail work of HDPE liner was completed the crew placed the 16 oz geotextile layer over the 60 mil liner. The geotextile was sewn together with a double prayer method.

This completes the repair area at the present time until GBI can get more areas prepared.

AEG and I left the site at 4.30 pm

Name: Dan Braatz

Signature:

WMH007183



**Attachment 5**  
**Tensiometer Certificate**





# SYSTEM LOAD CALIBRATION CERTIFICATE

GSE Lining Technology, Inc.

19103 Gundle Road  
Houston, Texas 77073  
800-435-2008  
281-443-8564  
Fax: 281-875-6010

GSE Equipment Number	OET-026
Device	WEGENER
Display Instrument	# 015990
Load Cell Number	# 092758

GSE verifies the calibration of field testing equipment with a T-Hyronics TC-S-0-500 lb. load cell, serial number 228696, and a T-Hydrionics 1028 transducer indicator, serial number 638, manufactured by T-Hydrionics, Inc. of Westerville, Ohio. The transducer was compared to standards certified traceable to the National Institute of Standards and Technology, Washington, D. C. The most recent factory force transducer calibration for this device was August 20, 2009.

The calibration of the tensiometer, designated GSE equipment number **OET-026** was verified using the calibration load cell indicator described above on **April 26, 2010**. The reading of the calibrations are recorded as "true load".


True Load (lb.)      0      50      100      150      200      250      300      350      400      450      500

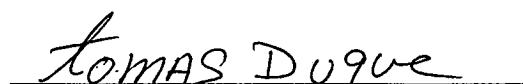
Display Load (Run #1)	0	50	100.2	150	200	250.2	300.5	350.2	400.1	450.2	500.4
--------------------------	---	----	-------	-----	-----	-------	-------	-------	-------	-------	-------

Display Load (Run #2)	0	50	100.4	150.6	200.7	250.7	300.6	350.6	400.9	450.2	500.3
--------------------------	---	----	-------	-------	-------	-------	-------	-------	-------	-------	-------

Display Load (Run #3)	0	50	100.3	150.2	200.4	250.3	300.3	350.4	400.5	450.3	500.2
--------------------------	---	----	-------	-------	-------	-------	-------	-------	-------	-------	-------

Display Load (Average)	0	50	100.3	150.2	200.3	250.4	300.4	350.4	400.5	450.2	500.3
---------------------------	---	----	-------	-------	-------	-------	-------	-------	-------	-------	-------

  
Wayne Leger  
Field Services Manager

  
Tomas Duque  
Utility Technician

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[www.gseworld.com](http://www.gseworld.com)

WMH007187





**Attachment 6**  
**Geomembrane Installation Documentation**



**Attachment 6.1**  
**Trial Welds Summary**





## TRIAL WELD SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs

Weld Requirements					
40-mil			60-mil		
	Peel	Shear		Peel	Shear
Fusion:	60 ppi	80 ppi	Fusion:	91 ppi	120 ppi
Extrusion:	52 ppi	80 ppi	Extrusion:	78 ppi	120 ppi



Sample ID	Date	Time	Ambient Temp	Seamer ID	Machine ID	Extrusion Welds		Fusion Welds		Peel (ppi)	Shear (ppi)	Observer	Pass/Fail	Comments
						Barrel Temp	Preheat Temp	Wedge Temp	Wedge Speed					
TWX-1	2/9/11	9.52	76	RB	1290	250	223	-	-	116/112	163	DTB	Pass	60/60
										112/114	164		Pass	
TWX-2	2/9/11	1.10	79	RB	1290	250	223	-	-	130/118	168	DTB	Pass	60/60
										111/114	176		Pass	
TWX-3	2/14/11	9.50	75	RB	1290	250	225	-	-	107/113	170	DTB	Pass	60/60
										109/111	172		Pass	
TWX-4	2/14/11	9.53	75	RB	1290	250	225	-	-	100/97	127	DTB	Pass	60/40
										105/96	128		Pass	
TWX-5	2/15/11	9.20	75	RB	1290	250	225	-	-	115/110	130	DTB	Pass	40/40 -repair-
										118/119	134		Pass	
TW-6	2/15/11	1.30	80	PV	2921	-	-	425	6.0	129/132	174	DTB	Pass	60/60 fusion
										135/144	176		Pass	
TWX-7	2/15/11	4.20	80	RB	1290	250	225	-	-	114/122	138	DTB	Pass	60/40
										122/117	135		Pass	
TWX-8	2/15/11	4.24	80	RB	1290	250	225	-	-	127/133	165	DTB	Pass	60/60
										122/119	172		Pass	
TWX-9	2/16/11	7.40	75	RB	1290	250	225	-	-	142/136	182	DTB	Pass	60/60 repairs
										153/153	172		Pass	

## TRIAL WELD SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs

### Weld Requirements

	40-mil			60-mil	
	Peel	Shear		Peel	Shear
Fusion:	60 ppi	80 ppi	Fusion:	91 ppi	120 ppi
Extrusion:	52 ppi	80 ppi	Extrusion:	78 ppi	120 ppi



Sample ID	Date	Time	Ambient Temp	Seamer ID	Machine ID	Extrusion Welds		Fusion Welds		Peel (ppi)	Shear (ppi)	Observer	Pass/Fail	Comments
						Barrel Temp	Preheat Temp	Wedge Temp	Wedge Speed					
TW-10	2/17/11	8.50	75	PV	2921	-	-	425	6.0	125/128	160	DTB		
										131/129	166		Pass	60/60
TWX-11	2/17/11	1.15	80	RB	1290	250	225	-	-	122/128	156	DTB		
										130/120	160		Pass	60/60

Notes:  
DTB Dan Braatz (AECOM)  
ppi pounds per inch  
Temp temperature (degrees Fahrenheit)  
Tie-in existing liner tie-in  
TW Trial weld-fusion  
TWX Trial weld-extrusion

**Attachment 6.2**  
**Panel Seaming Summary**



## PANEL SEAMING SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



Seam ID		Date	Start Time	Seam Location	Seamer ID	Machine ID	Station		Seam Length (ft)	Observer	Comments
							Beg.	End			
P2-1	P2-1	2-9-2011	10:05	P2-2 To P-26	RB	1290	2+77	2+55	22	DTB	Bench -Wrinkle Repair Cut
P-26	P-26	2-9-2011	10:25	P2-1 to P-25	RB	1290	2+55	2+44	11	DTB	Bench-Wrinkle Repair Cut
P-25	P-25	2-9-2011	10:35	P-26 to P-24	RB	1290	2+44	2+22	22	DTB	Bench-Wrinkle Repair Cut
P-24	P-24	2-9-2011	10:45	P-25 to P-23	RB	1290	2+22	2+00	22	DTB	Bench-Wrinkle Repair Cut
P-23	P-23	2-9-2011	10:55	P-24 to P-23	RB	1290	2+00	1+91	9	DTB	Bench-Wrinkle Repair Cut
P-23	P-23	2-9-2011	11:00	P-24 to P-23	RB	1290	2+00	1+90	10	DTB	Bench-Wrinkle Repair Cut
P-25	P-25	2-9-2011	1:20	P-26 to P-24	RB	1290	1+44	1+22	22	DTB	Slope-Wrinkle Repair Cut
P-24	P-24	2-9-2011	1:30	P-25 to P-23	RB	1290	2+22	2+00	22	DTB	Slope-Wrinkle Repair Cut
P-23	P-23	2-9-2011	1:45	P-24 to P-22	RB	1290	2+00	1+79	21	DTB	Slope-Wrinkle Repair Cut
P-26	P-26	2-9-2011	2:00	P2-1 to P-25	RB	1290	2+44	2+55	11	DTB	Slope-Wrinkle Repair Cut
P2-1	P2-1	2-9-2011	2:15	P2-2 to P-26	RB	1290	2+55	2+77	22	DTB	Slope-Wrinkle Repair Cut
P-16	S-16	2-14-2011	10:00	West Slope Encap.	RB	1290	0+00	0+20	20	DTB	New Encapsulation
P-17	S-17	2-14-2011	10:15	West Slope Encap.	RB	1290	0+20	0+38	18	DTB	New Encapsulation
P-20	RP-1	2-15-2011	2:00	West Slope	PV	2921	1+15	1+34	19	DTB	
P-20	RP-2	2-15-2011	2:15	West Slope	PV	2921	1+12	1+15	3	DTB	
RP-1	RP-2	2-15-2011	2:30	West Slope	PV	2921	0+00	0+30	30	DTB	
P-19	RP-2	2-15-2011	2:55	West Slope	PV	2921	0+92	1+12	20	DTB	
RP-2	RP-3	2-15-2011	3:05	West Slope	PV	2921	0+00	0+30	30	DTB	
P-18	RP-3	2-15-2011	3:00	West Slope	PV	2921	0+70	0+90	20	DTB	
P-19	RP-3	2-15-2011	3:03	West Slope	PV	2921	0+90	0+92	2	DTB	
RP-3	RP-4	2-15-2011	3:27	West Slope	PV	2921	0+00	0+30	30	DTB	

## PANEL SEAMING SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



Seam ID		Date	Start Time	Seam Location	Seamer ID	Machine ID	Station		Seam Length (ft)	Observer	Comments
							Beg.	End			
P-17	RP-4	2-15-2011	3:40	West Slope	PV	2921	0+68	0+52	16	DTB	New Encapsulation
RP-4	S-17	2-15-2011	4:00	Toe Tie-in	RB	1290	0+30	0+68	30	DTB	
RP-4	P-17	2-15-2011	4:30	Toe Tie-in	RB	1290	0+68	0+60	8	DTB	
RP-4	P-18	2-15-2011	4:50	Toe Tie-in	RB	1290	0+68	0+72	4	DTB	
RP-3	P-18	2-15-2011	4:55	Toe Tie-in	RB	1290	0+72	0+90	18	DTB	
RP-3	P-19	2-15-2011	5:00	Toe Tie-in	RB	1290	0+90	0+94	4	DTB	
RP-2	P-19	2-15-2011	5:05	Toe Tie-in	RB	1290	0+94	1+12	18	DTB	
RP-2	P-20	2-15-2011	5:10	Toe Tie-in	RB	1290	1+12	1+16	4	DTB	
RP-1	P-20	2-15-2011	5:30	Toe Tie-in	RB	1290	1+16	1+34	18	DTB	
RP-1	P-21	2-15-2011	6:00	Toe Tie-in	RB	1290	1+34	1+38	4	DTB	
RP-1	RP-5	2-17-2011	10:00	West Slope	PV	2921	0+00	0+30	30	DTB	
RP-5	RP-6	2-17-2011	10:15	West Slope	PV	2921	0+00	0+28	28	DTB	
RP-5	P-21	2-17-2011	10:55	West Slope	PV	2921	1+38	1+56	18	DTB	
RP-5	P-22	2-17-2011	10:54	West Slope	PV	2921	1+56	1+58	2	DTB	
RP-6	P-22	2-17-2011	10:47	West Slope	PV	2921	1+56	1+74	18	DTB	
RP-5	P-21	2-17-2011	1:10	West Slope Toe	RB	1290	1+39	1+56	17	DTB	
RP-5	P-22	2-17-2011	1:17	West Slope Toe	RB	1290	1+56	1+59	3	DTB	
RP-6	P-22	2-17-2011	1:20	West Slope Toe	RB	1290	1+59	1+79	20	DTB	
RP-6	P-23	2-17-2011	2:15	West Slope Toe	RB	1290	0+00	0+30	30	DTB	

Notes:  
DTB Dan Braatz  
Tie-in existing liner tie-in  
P-# existing panel number  
RP-# repair panel number



**Attachment 6.3**  
**Non-Destructive Seam Testing Summary**



## NON-DESTRUCTIVE SEAM TESTING SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



### Seam Requirements

Pressurize To: 30 psi , max allowable pressure drop: 2 psi after 5 min

Seam ID		Date	Seam Location	Station		Test Crew	Air Testing					Vacuum Test	Observer	Comments
				Beg	End		Time		Pressure		Results			
							Beg.	End	Beg.	End	P/F	P/F		
P2-1	P2-1	2/10/11	P2-2 To P-26	2+77	2+55	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-26	P-26	2/10/11	P2-1 to P-25	2+55	1+24	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-25	P-25	2/10/11	P-26 to P-24	2+44	2+22	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-24	P-24	2/10/11	P-25 to P-23	2+22	2+00	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-23	P-23	2/10/11	P-24 to P-23	2+00	1+91	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-23	P-23	2/10/11	P-24 to P-23	2+00	1+90	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-25	P-25	2/10/11	P-26 to P-24	2+44	2+22	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-24	P-24	2/10/11	P-25 to P-23	2+22	2+00	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-23	P-23	2/10/11	P-24 to P-22	2+00	1+78	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-26	P-26	2/10/11	P2-1 to P-25	2+44	2+55	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P2-1	P2-1	2/10/11	P2-2 to P-26	2+55	2+77	FV	-	-	-	-	-	P	DTB	Wrinkle Repair Cut
P-16	S-16	2/14/11	West Berm Encap.	0+00	0+20	FV	-	-	-	-	-	P	DTB	40/60 Encapsulation
P-17	S-17	2/14/11	West Berm Encap.	0+20	0+38	FV	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-1	RP-2	2/15/11	West Berm Slope.	0+00	0+30	FV	3:50	3:55	30	30	P	-	DTB	New Repair Panel Placement
RP-2	RP-3	2/15/11	West Berm Slope.	0+00	0+30	FV	3:52	3:57	30	30	P	-	DTB	New Repair Panel Placement
RP-3	RP-4	2/15/11	West Berm Slope.	0+00	0+30	FV	4:02	4:07	30	30	P	-	DTB	New Repair Panel Placement
P-17	RP-4	2/15/11	West Berm Slope.	0+68	0+52	FV	4:10	4:15	30	30	P	-	DTB	New Repair Panel Placement
P-18	RP-3	2/15/11	West Berm Slope.	0+90	0+70	FV	4:11	4:16	30	30	P	-	DTB	New Repair Panel Placement
P-19	RP-2	2/15/11	West Berm Slope.	1+12	0+92	FV	4:12	4:17	30	30	P	-	DTB	New Repair Panel Placement
P-20	RP-1	2/15/11	West Berm Slope.	1+34	1+14	FV	4:30	4:35	30	-	FAIL	-	DTB	Entire Seam Capped
RP-4	S-17	2/16/11	West Berm Encap.	0+38	0+68	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-4	P-17	2/16/11	West Berm T oe	0+68	0+60	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-4	P-18	2/16/11	West Berm T oe	0+72	0+68	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement

Non-Destructive Seam Summary

1 of 2

## NON-DESTRUCTIVE SEAM TESTING SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



### Seam Requirements

Pressurize To: 30 psi , max allowable pressure drop: 2 psi after 5 min

Seam ID		Date	Seam Location	Station		Test Crew	Air Testing					Vacuum Test	Observer	Comments
				Beg	End		Time		Pressure		Results			
							Beg.	End	Beg.	End	P/F	P/F		
RP-3	P-18	2/16/11	West Berm T oe	0+72	0+90	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-3	P-19	2/16/11	West Berm T oe	0+90	0+94	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-2	P-19	2/16/11	West Berm T oe	0+94	1+12	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-2	P-20	2/16/11	West Berm T oe	1+12	1+16	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-1	P-20	2/16/11	West Berm T oe	1+16	1+34	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-1	P-21	2/16/11	West Berm T oe	1+34	1+38	PV	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-5	RP-6	2/17/11	Slope	0+00	0+30	FV	10:50	10:55	30	30	P	-	DTB	New Repair Panel Placement
RP-5	RP-1	2/17/11	Slope	0+00	0+30	FV	10:56	11:01	30	30	P	-	DTB	New Repair Panel Placement
RP-5	P-21	2/17/11	Slope	1+38	1+56	FV	11:15	11:20	30	29	P	-	DTB	New Repair Panel Placement
RP-6	P-22	2/17/11	Slope	1+58	1+78	FV	11:24	11:29	30	30	P	-	DTB	New Repair Panel Placement
RP-5	P-21	2/17/11	Toe	1+39	1+56	JR	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-5	P-22	2/17/11	Toe	0+65	1+56	JR	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-6	P-22	2/17/11	Toe	1+59	1+78	JR	-	-	-	-	-	P	DTB	New Repair Panel Placement
RP-6	P-23	2/17/11	Slope	0+00	0+30	JR	-	-	-	-	-	P	DTB	New Repair Panel Placement

#### Notes:

DTB Dan Braatz  
EOS end of seam  
Tie-in existing liner tie-in  
P-# existing panel number  
RP-# repair panel number

**Attachment 6.4**  
**Geomembrane Repair Summary**





## GEOMEMBRANE REPAIR SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



Repair Number	Date Repaired	Seam ID			Panel (s)	Location	Description of Damage	Type/Size of Repair (ft)	Repair Crew	Date Tested	Tested By	Observer	Comments
1	2/9/2011	P2-2	P2-1		P2-1, P2-2	2+99	Liner Cut	1 x 3	RB	2/10/2011	FV	DTB	
2	2/9/2011	P2-1			P2-1	2+67	Liner Cut	1 x 1	RB	2/10/2011	FV	DTB	
3	2/9/2011	P2-1	P-26		P2-1, P-26	2+55	Tee	2 x 3	RB	2/10/2011	FV	DTB	
4	2/9/2011	P-26	P-25		P-25, P-26	2+44	Tee	1.5 x 1.5	RB	2/10/2011	FV	DTB	
5	2/9/2011	P-25	P-24		P-24, P-25	2+22	Tee	1.5 x 3	RB	2/10/2011	FV	DTB	
6	2/9/2011	-	-		P-24	2+12	Liner Cut	2 x 3	RB	2/10/2011	FV	DTB	
7	2/9/2011	-	-		P-24	2+04	Liner Cut	1 x 1	RB	2/10/2011	FV	DTB	
8	2/9/2011	P-24	P-23		P-24, P-23	2+00	Tee	4 x 4	RB	2/10/2011	FV	DTB	
9	2/9/2011	-	-		P-23	1+93	Liner Cut	1 x 1	RB	2/10/2011	FV	DTB	
10	2/9/2011	-	-		P-23	1+92	Liner Cut	1 x 1	RB	2/10/2011	FV	DTB	
11	2/9/2011	-	-		P-25	2+30	Liner Cut	2 x 3	RB	2/10/2011	FV	DTB	
12	2/9/2011	-	-		P-25	2+34	Liner Cut	2 x 4	RB	2/10/2011	FV	DTB	
13	2/9/2011	-	-		P-25	2+34	Tear	2 x 3	RB	2/10/2011	FV	DTB	
14	2/9/2011	P-25	P-25		P-25	2+26	Liner Cut	2 x 2	RB	2/10/2011	FV	DTB	
15	2/9/2011	P-25	P-24		P-25/P-24	2+22	Tee	2 x 3	RB	2/10/2011	FV	DTB	
16	2/9/2011	P-24	P-23		P-24/P-23	2+00	Tee	2 x 2	RB	2/10/2011	FV	DTB	
17	2/9/2011	-	-		P-24	2+11	Liner Cut	2 x 3	RB	2/10/2011	FV	DTB	
18	2/9/2011	-	-		P-23	1+89	Liner Cut	1.5 x 1.5	RB	2/10/2011	FV	DTB	
19	2/9/2011	-	-		P2-1	2+69/ 5' B.C.	Hole	2 x 2	RB	2/10/2011	FV	DTB	
20	2/9/2011	P2-1	P-26	P2-1	P2-1/P-26	2+55/ 6' B.C.	Tee	1.5 x 1.5	RB	2/10/2011	FV	DTB	
21	2/9/2011	P-25	P-26		P-25/P-26	2+44/ 6' B.C.	Tee	2 x 3	RB	2/10/2011	FV	DTB	

## GEOMEMBRANE REPAIR SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



Repair Number	Date Repaired	Seam ID			Panel (s)	Location	Description of Damage	Type/Size of Repair (ft)	Repair Crew	Date Tested	Tested By	Observer	Comments
22	2/9/2011	-	-		P-26	2+47/ CREST-	Wrinkle	3 x 6	RB	2/10/2011	FV	DTB	
23	2/9/2011	-	-		P-26	2+46/ 8' B.C.	Tear	3 x 3	RB	2/10/2011	FV	DTB	
24	2/9/2011	-	-		P2-1	2+57/ 4' B.C.	Liner Cut	1.5 x 1.5	RB	2/10/2011	FV	DTB	
25	2/9/2011	-	-		P2-1	2+62/CREST	Tear	1.5 x 1.5	RB	2/10/2011	FV	DTB	
26	2/9/2011	-	-		P-26	2+54/8' B.C.	Tear	1 x 1	RB	2/10/2011	FV	DTB	
27	2/9/2011	P2-1	P2-2		P2-1/P2-2	2+77 4' B.C.	Tee	2 x 3	RB	2/10/2011	FV	DTB	
28	2/14/2011	P-16	P-17		P16/P-17	0+46	Tee	2 x 3	RB	2/14/2011	FV	DTB	60/40 mil
29	2/14/2011	-			S-17	0+57	Hole	1 x 1	RB	2/14/2011	FV	DTB	40 mil
30	2/15/2011	-			S-17	0+57	Rock Puncture	1 x 1	JR	2/15/2011	JR	DTB	40 mil
31	2/15/2011	RP-4	P-17	P-18	RP-4/P-17,18	0+68	Tee	2 x 2	RB	2/16/2011	PV	DTB	
32	2/15/2011	RP-4	RP-3	P-18	RP-3,4/P-18	0+64	Tee	1 x 1	RB	2/16/2011	PV	DTB	
33	2/15/2011	RP-3	P-19	P-18	RP-3/P-18,19	0+90	Tee	1 x 1	RB	2/16/2011	PV	DTB	
34	2/15/2011	RP-2	RP-4	P-19	RP-2,3/ P-19	0+94	Tee	2 x 2	RB	2/16/2011	PV	DTB	
35	2/15/2011	RP-2	P-19	P-20	RP-2/P-19,20	1+12	Tee	1 x 1	RB	2/16/2011	PV	DTB	
36	2/15/2011	RP-1	RP-2	P-20	RP-1,2/P-20	1+16	Tee	2 x 4	RB	2/16/2011	PV	DTB	
37	2/15/2011	RP-1	P-20	P-21	RP-1/P-20	1+34	Tee	1 X 1	RB	2/16/2011	PV	DTB	
38	2/16/2011	P-17	S-17	RP-4	RP-4/ P-17/S-17	0+48	Tee	3 X 3	RB	2/16/2011	PV	DTB	
39	2/16/2011	RP-3,4	P-17,18		RP-3,4/ P-17,18	0+68	Tee	4 X4	RB	2/16/2011	PV	DTB	
40	2/16/2011	RP-2,3	P-18,19		RP-2,3/P-18,19	0+90	Tee	5 X 6	RB	2/16/2011	PV	DTB	
41	2/16/2011	RP-1,2	P-19,20		RP-1,2/P-19,20	1+12	Tee/DS-R1	5 X 8	RB	2/16/2011	PV	DTB	

## GEOMEMBRANE REPAIR SUMMARY

Waste Management of Hawaii  
Waimanalo Gulch Sanitary Landfill  
AECOM Project Number: 60191059  
Project Name: Cell E6 Sideslope Repairs



Repair Number	Date Repaired	Seam ID			Panel (s)	Location	Description of Damage	Type/Size of Repair (ft)	Repair Crew	Date Tested	Tested By	Observer	Comments
42	2/16/2011	RP-1	P-20		RP-1/ P-20	1+12-1+34	FAILED AIR	3 X 20	RB	2/16/2011	PV	DTB	
43	2/16/2011	RP-1	P-20		RP-1/P-20	1+34	Tee	1 X 1	RB	2/16/2011	PV	DTB	
44	2/16/2011	RP-1	P-20		RP-1/ P-20	1+34	Tee	1 X 1	RB	2/16/2011	PV	DTB	
45	2/17/2011	RP-5	P-21	P-22	RP-5/ P-21,22	1+56	Tee	1.5 x 1.5	RB	2/17/2011	JR	DTB	
46	2/17/2011	RP-1,5	P-21		RP-1,5/P-21	1+38	Tee	3 x 4	RB	2/17/2011	JR	DTB	
47	2/17/2011	RP-5,6	P-22		RP-5,6/P-22	1+59	Tee	2 x 2	RB	2/17/2011	JR	DTB	
48	2/17/2011	RP-6	P-22,23		RP-6/P-22,23	1+78	Tee	4 x 4	RB	2/17/2011	JR	DTB	
49	2/17/2011	RP-5,6	P-21,22		RP-5,6/P-21,26	1+556	Tee	2 x 4	RB	2/17/2011	JR	DTB	
50	2/17/2011	RP-1,5	P-21		RP-1,5/ P-21	1+37	Tee	2 x 2	RB	2/17/2011	JR	DTB	
51	2/17/2011	RP-6	P-23		RP-6/ P-23	1+78	Cut Wrinkle	2 x 6	RB	2/17/2011	JR	DTB	

Notes:  
BC below crest  
DS destructive sample  
Tie-in existing liner tie-in  
Int intersection of seams  
P-# panel number  
Tee patch "T-shaped" intersection of seams



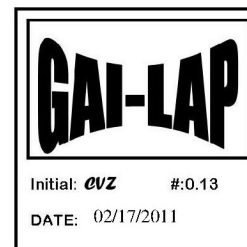


**Attachment 6.5**  
**Destructive Seam Laboratory Data**





# Precision Geosynthetic Laboratories International



Ron Boyle  
**AECOM**  
1001 Bishop Street  
Suite# 1600  
Honolulu, HI 96813

Dear Mr. Boyle:

Thank you for consulting Precision Geosynthetic Laboratories International (PGLI) for your material testing needs.

Enclosed is the **final** laboratory report for the seam testing of one (1) 60 mil HDPE seam sample.

**PROJECT NAME:** Waimanalo Gulch Sanitary Landfill/ Project No. 60191059.02.04

**REFERENCE PGL JOB NO.:** G110098

**DATE RECEIVED:** February 17, 2011

**DATE REPORTED:** February 17, 2011

**SAMPLE SENT BY:** Dan Frerich, AECOM

**SAMPLE IDENTIFICATIONS:**

**SAMPLE ID**

DS- R1 RP1/PP-2 0+05 Sample 2-15-2011 E6 West Slope Repairs

**PGL CONTROL NUMBER**

58523

**TESTS REQUIRED:**

**TEST METHOD**

ASTM D6392

ASTM D6392

**DESCRIPTION**

Shear Bond Strength

Peel Bond Adhesion

**TEST CONDITIONS:** The sample is conditioned for a minimum of one hour in the laboratory at  $22 \pm 2^{\circ}\text{C}$  ( $71.6 \pm 3.6^{\circ}\text{F}$ ) and at  $60 \pm 10\%$  relative humidity prior to test.

**TEST RESULTS:** The test results are summarized in Table 1.

**PRECISION GEOSYNTHETIC LABORATORIES INTERNATIONAL**

Maria Espitia  
Quality Assurance

Carmelo V. Zantua  
Technical/Laboratory Director

It shall be noted that the sample tested is believed to be true representatives of the material produced under the designation herein stated. In addition, the attached laboratory tests results are considered indicative only of the quality of samples/specimens that were actually tested. The appropriate test methods hereby employed are based on the current and accepted industry practices. Precision Geosynthetic Laboratories neither accepts responsibility for nor makes claims to the intended final use and purpose of the material. The test data and all associated project information shall be held confidential and not to be reproduced and/or disclosed to other parties except in full and with prior written approval from pertinent entity duly authorized by the respective client or from the client itself. It is a policy of the company to keep physical records of each job for two (2) years commencing from the date of receipt of the samples and keep its corresponding electronic file for seven (7) years. **Failed seam samples are kept for two (2) years and good seam samples are disposed of after two (2) weeks.** On the other hand, should you need us to keep them at longer time, please advise us in writing.

**TABLE 1.**  
**SEAM PEEL AND SHEAR TEST RESULTS**  
**MATERIAL: 60mil HDPE SEAM**  
**SEAM TYPE: Fusion Weld**

CLIENT: **AECOM**  
PROJECT: **Waimanalo Gulch Sanitary Landfill**  
**Project No. 60191059.02.04**  
DATE REC'D: **17-Feb-11**

QC'd By: *Maria Espitia*  
TEST METHOD: **ASTM D6392**

PGL JOB #: **G110098**

DATE REPORT: **17-Feb-11**

Crosshead Speed: 2 in/min						Crosshead Speed: 2 in/min				
SAMPLE ID	PGL CONTROL #	SHEAR EVALUATION				PEEL EVALUATION				
		MAXIMUM STRENGTH (lb/in width)	% Elongation	Locus of Break	PROJECT SPEC. (lb/in width)	SPECIMEN NUMBER	MAXIMUM STRENGTH (lb/in width)	% INCURSION (%)	LOCUS OF BREAK	PROJECT SPEC. (lb/in width)
DS- R1 RP-1/PP-2 0+05 Sample 2-15-2011 E6 West Slope Repairs	58523	171	> 50%	BRK		1 Outside	124	0	SE1	
		176	> 50%	BRK		2 Outside	131	0	SE1	
		176	> 50%	BRK		3 Outside	145	0	SE1	
		174	> 50%	BRK		4 Outside	141	0	SE1	
		180	> 50%	BRK		5 Outside	129	0	SE1	
						AVG:	134			
						STD. DEV.	9			
						1 Inside	131	0	SE1	
						2 Inside	134	0	SE1	
						3 Inside	129	0	SE1	
				4 Inside	141	0	SE1			
				5 Inside	142	0	SE1			
AVG.		175				AVG:	135			
STD. DEV.		3				STD. DEV.	6			

**BREAK DESCRIPTION (ASTM D6392 FUSION):**

AD ADHESION FAILURE.  
BRK BREAK IN SHEETING.  
SE1 BREAK AT OUTER EDGE OF SEAM.  
SE2 BREAK AT INNER EDGE OF SEAM.  
AD-BRK BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE.  
SIP SEPARATION IN THE PLANE OF THE SHEET.

**EXTRUSION:**

AD1 ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD.  
AD2 ADHESION FAILURE.  
AD-WLD BREAK THROUGH THE FILLET.  
SE1 BREAK AT BOTTOM EDGE OF SEAM.  
SE2 BREAK AT TOP EDGE OF SEAM.  
SE3 BREAK AT BOTTOM EDGE OF SEAM (for PEEL only)  
BRK1 BREAK IN BOTTOM SHEETING.  
BRK2 BREAK IN TOP SHEETING.  
AD-BRK BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE.  
HT BREAK AT EDGE OF HOT TACK  
SIP SEPARATION IN THE PLANE OF THE SHEET.

By accepting the data and results presented on this report, the Client agrees to limit the liability of Precision Geosynthetic Laboratories from Client and all other parties for claims on issues, due to the use of this data, to the cost for the respective tests presented in this report; and the Client agrees to indemnify and hold harmless Precision Geosynthetic Laboratories from and against all liabilities in excess of the aforementioned limit.



**Precision Geosynthetic Laboratories International**



**WMH007212**

**Attachment 7**  
**Field Revisions**





**Document 00660**  
**REQUEST FOR INFORMATION (RFI)**

**CONTRACTOR'S REQUEST**

RFI Date: 5/8/10

RFI No. 026- GCL Overlap

Drawing No. N/A

Specification No. 02777, 3.05 (A)

Date Information Required: 5/10/10

**Information Required:** Specification Section 02777, 3.05, (A) states that "On slopes steeper than 10 horizontal to 1 vertical, all geosynthetic clay liners shall be continuous down the slope; that is, no horizontal seams shall be allowed on the slope."

Currently for the Phase II West Berm Cap and the West Berm Buttress Cap areas, the slope areas are longer than the GCL roll lengths in some areas. The new rolls that were ordered are 150 feet in length whereas the slopes have lengths in some areas are greater than 190 feet. In past projects at WGSL where this situation was encountered, an overlap of 5 feet and gluing with 3M Super 77 glue, as recommended by the manufacturer, was allowed for horizontal cross seams.

Please confirm if this method can be used.

By: Ron Boyle

Date: 5/8/10

Title: CQA Officer

**OWNER'S RESPONSE**

The proposed method is accepted. In addition, the procedures and requirements outlined on Page 0660-1B shall be followed to apply 3M Super 77 glue.

By: \_\_\_\_\_ F. Settepani

Date: \_\_\_\_\_ 10 May 2010

Title: \_\_\_\_\_ Sr. Eng./Geosyntec Consultants, Inc.

Cells E5 through E8 (For Bid)

Request for Information (RFI)  
Waimanalo Gulch Landfill

P:\PRJ2003Geo\WMI\Waimanalo\WL0770\Cells E5 through E8 (2010 CQA)\Submittals & RFIs\Response to RFI 026 (10May10).doc

Page 00660-1

October 2009

## **Waimanalo Gulch Landfill**

### **Adhesive Application Procedures for Geosynthetic Clay Liner (GCL)**

As used previously, the following procedure shall be used for each geosynthetic clay liner (GCL) seam:

- Overlap the upper GCL panel over the lower GCL panel by 5-ft.
- Fold back the upper GCL panel to expose the underside of the upper GCL panel.
- Uniformly apply 3M-Super 77 adhesive in the area between 6 and 18 inches (i.e., 1-foot-wide) along the entire width of both the upper and lower GCL panels. That is: leave the area between 0 and 6 inches from the edge along the entire width of the upper and lower panels unglued.
- On both panels, cover the entire width of the 12-inch-wide surface area of the seam with adhesive.
- Lay the upper GCL panel on top of the lower GCL panel and press both panels together by hand; use a roller to apply additional bonding pressure.

### **Other Requirements**

In addition to the procedures described above, other requirements are:

- Limit the adhesive-bonded seams to the lower end (lower 20%) of a sideslope length.
- Stagger bonded seams at least 5 feet (bottom of one overlap to the top of adjacent overlap) so that there are no continuous seams across multiple GCL panels.
- Shingle the overlapping panels so that the upslope GCL panel is over the top of downslope panel. At the exposed panel end, the geotextile backing of the upslope panel shall be heat bonded to geotextile backing of the underlying GCL to help contain the bentonite placed along the end.

## CONTRACTOR'S RESPONSE

This clarification will result in no increase in Contract Price or Contract Time. \_\_\_\_ Concur \_\_\_\_ Do Not Concur

Comments: \_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

**END OF DOCUMENT**

